

HCAL testbeam analysis update

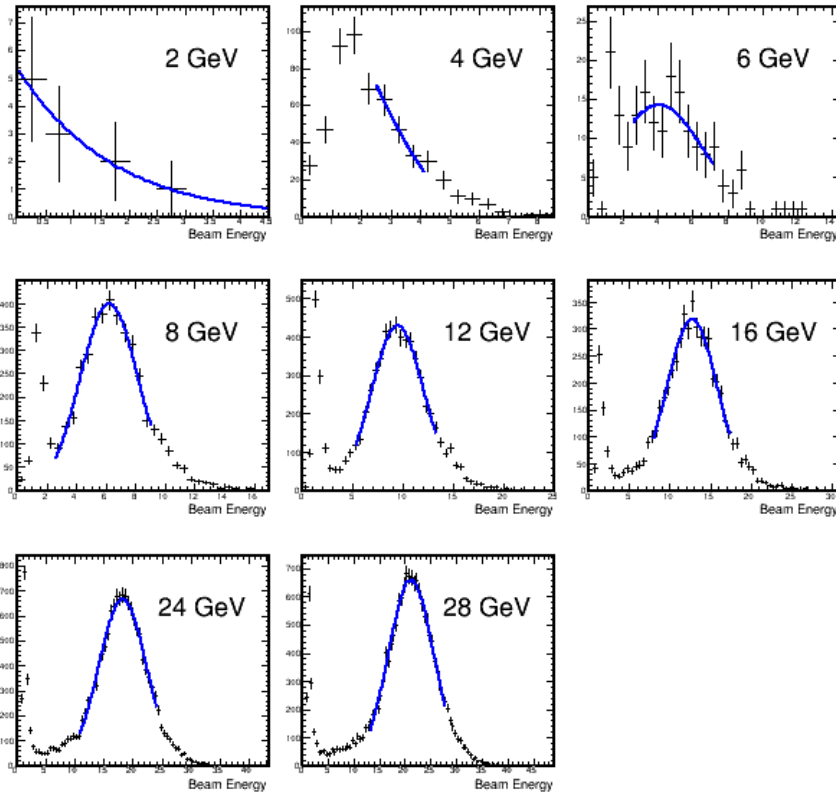
Abhisek Sen

Hadron calibration

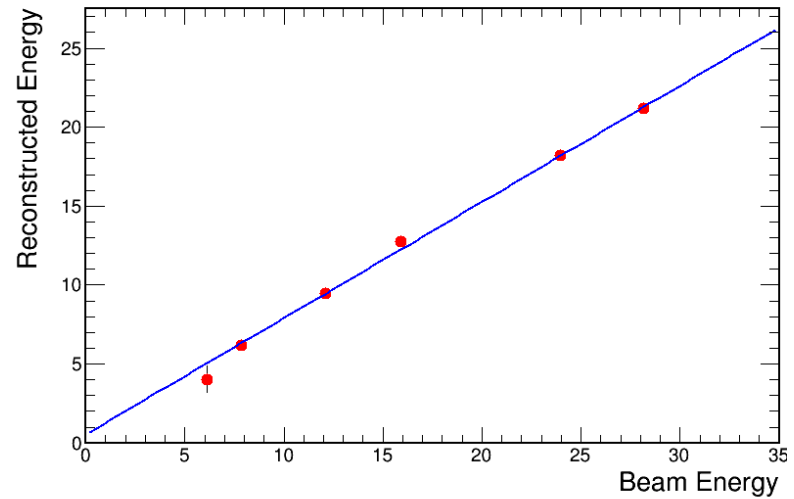
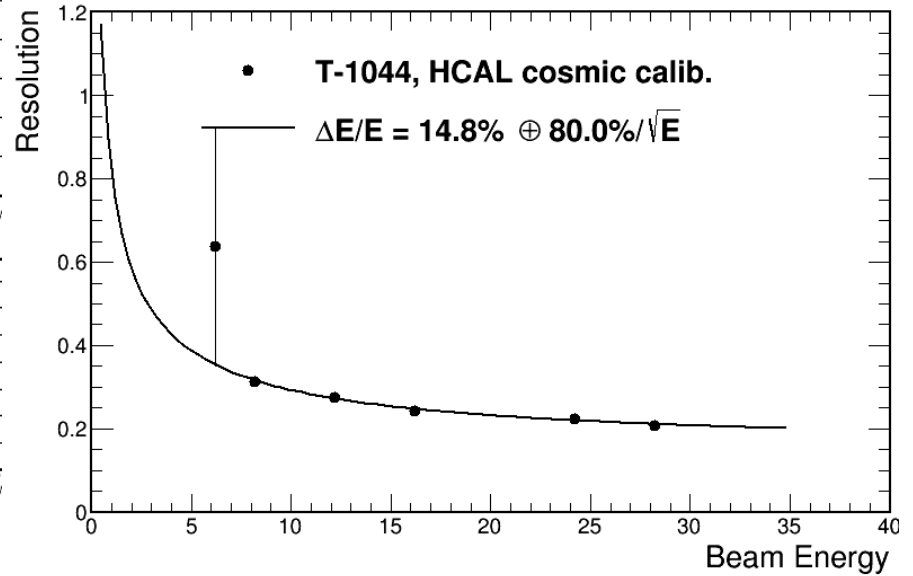
- ❖ New:
 - Refine data selection
 - Apply hodoscope cuts
- ❖ Code:
 - <https://github.com/sPHENIX-Collaboration/analysis/tree/master/Prototype2/HCAL/ShowerCalib>
- ❖ Hadron Selection:
 - Cherenkov cut: $C2_inner < 20$
 - No hit in the veto counter ($ADC < 15$)
 - Valid Single hodoscope fired (V/H)
- ❖ Shower event categorization
 - MIP through EMCAL and HCALIN
 - MIP through EMCAL
 - Full shower calibration with EMCAL

EMCAL and HCALIN MIP events

HCALOUT only

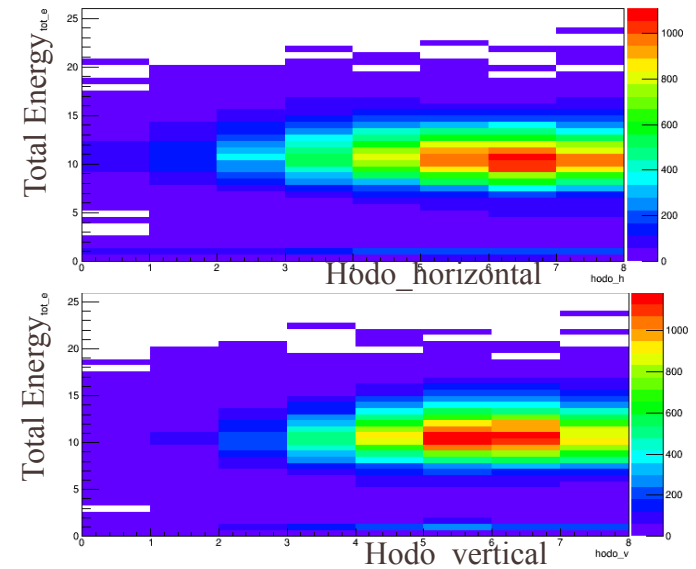
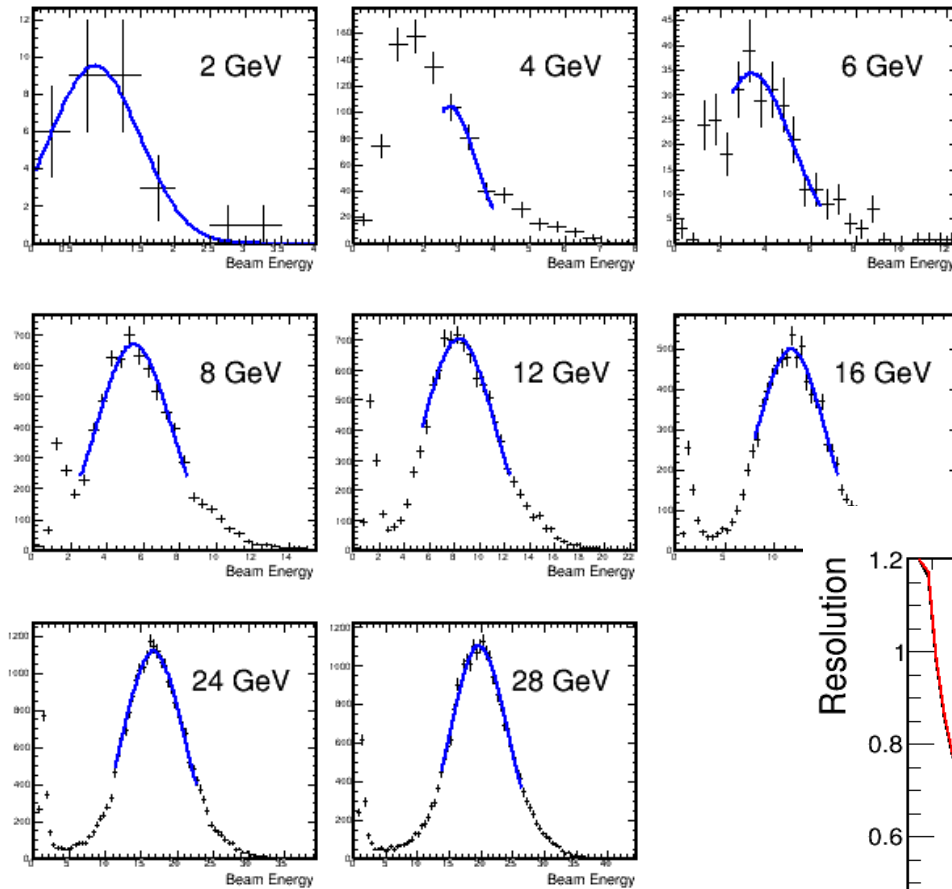


Tower-to-tower calibration is from cosmic MIP events.

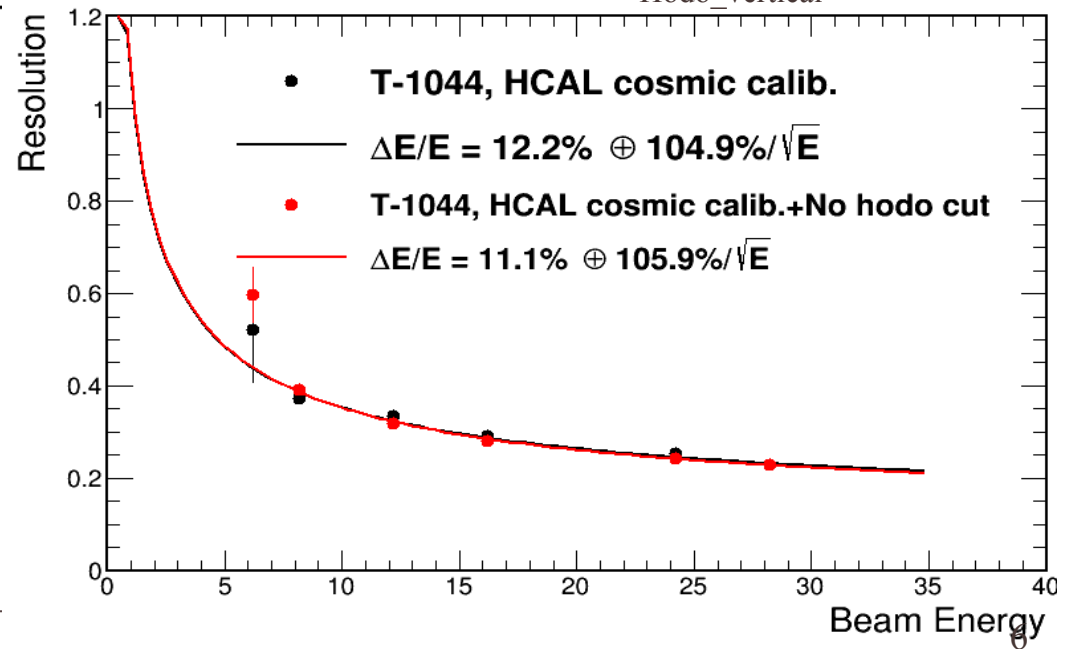


EMCAL MIP events

HCAL with cosmic calibrations

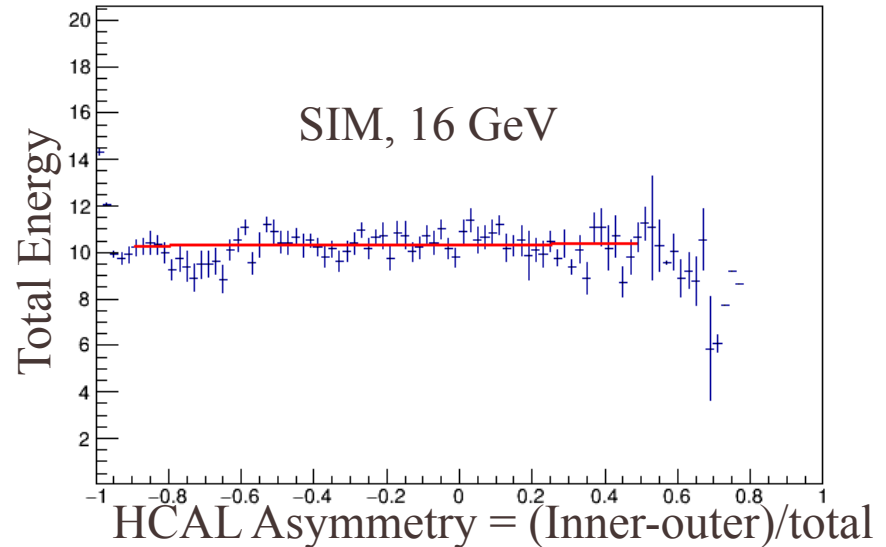
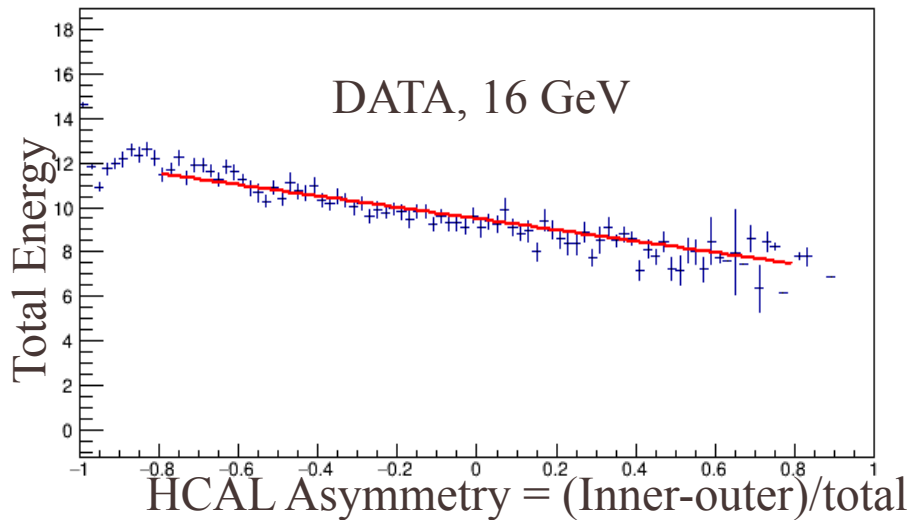


Tower-to-tower calibration is from cosmic MIP events.



Balancing calorimeters

Inner and outer are balanced?



- ❖ Inner and outer not balanced.
- ❖ A miscalibration on the overall scale between two segments.
- ❖ Cosmic calibration was tuned with HG channels but above data is LG.
 - Gain difference of 32 (inner) and 16 (outer) was taken care of.

Methods

Method 1: $E_{reco} = E_{inner} + p * E_{outer}$

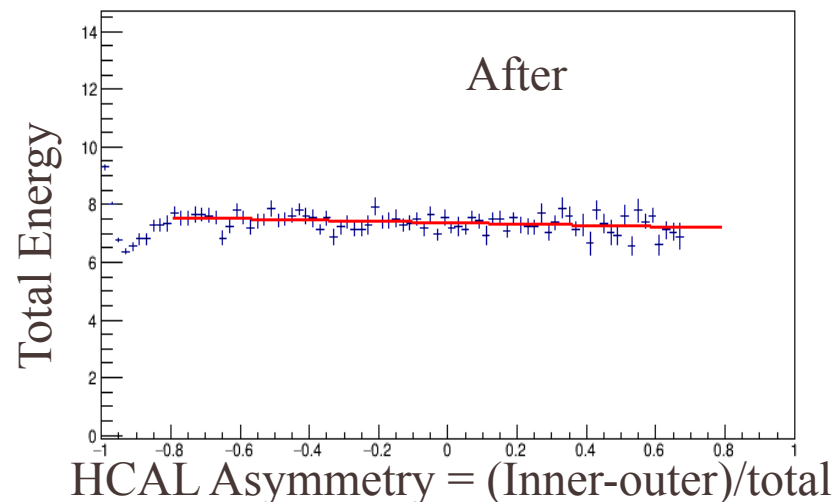
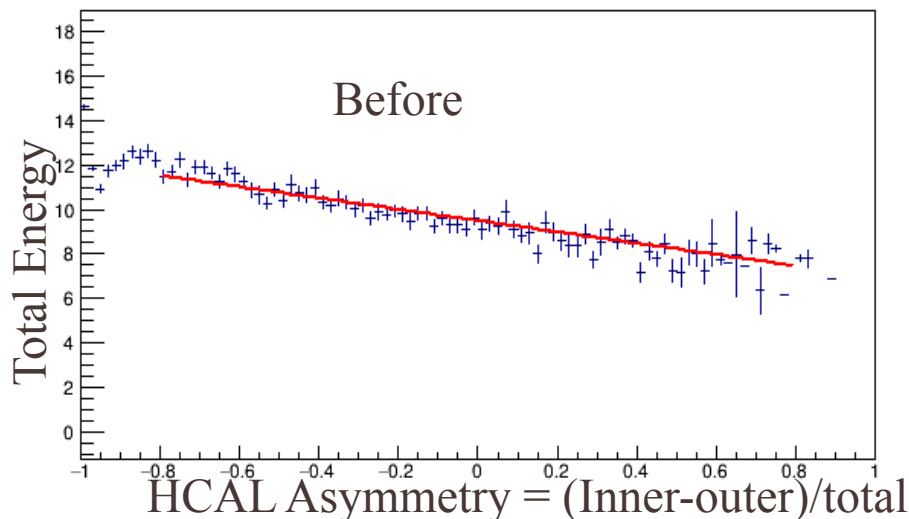
Use Minuit to minimize: $\sigma_{E_{reco}} / \langle E_{reco} \rangle$

$p \sim 0.5$ which gave best possible resolution.

(see my presentation from 26th July HCAL meeting + testbeam workfest)

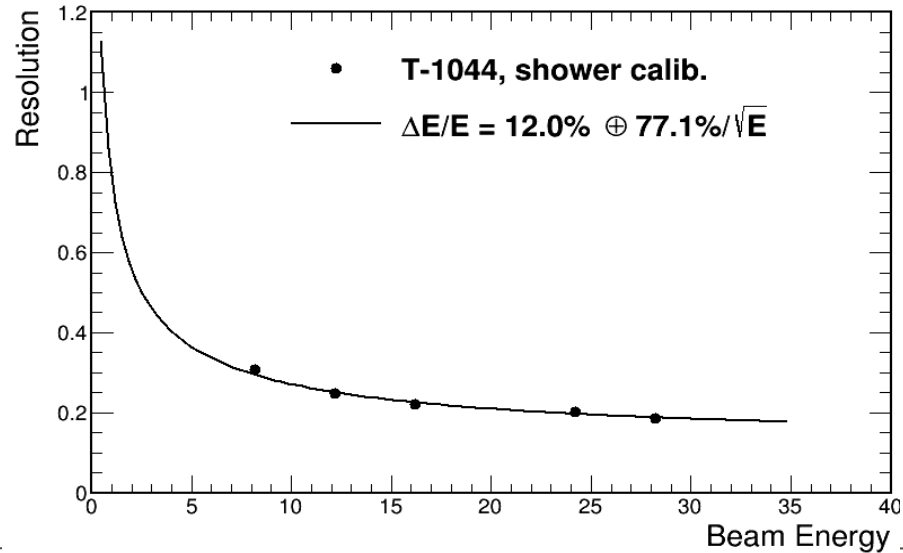
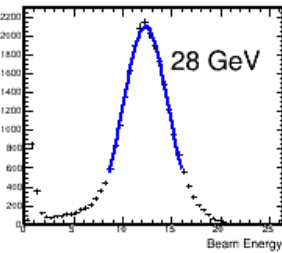
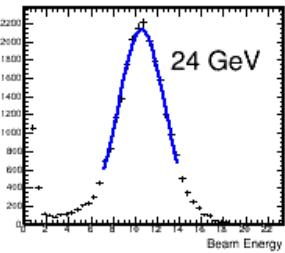
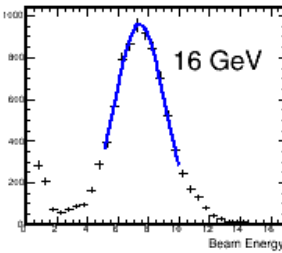
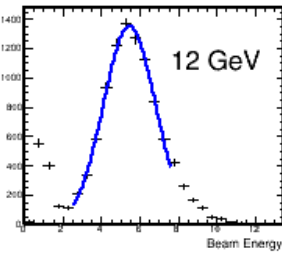
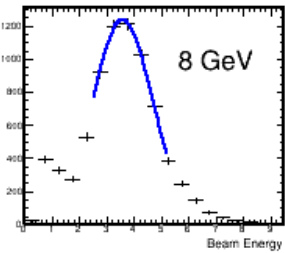
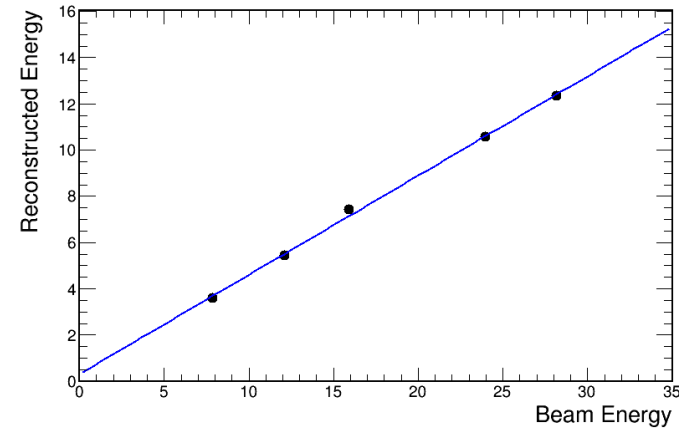
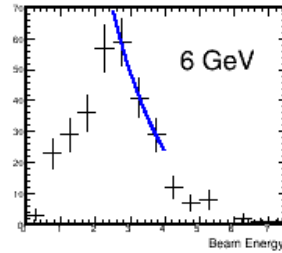
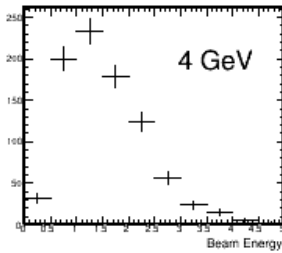
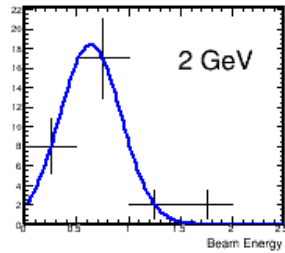
Method 2: $E_{reco} = E_{inner} + p * E_{outer}$

Find p when slope ~ 0



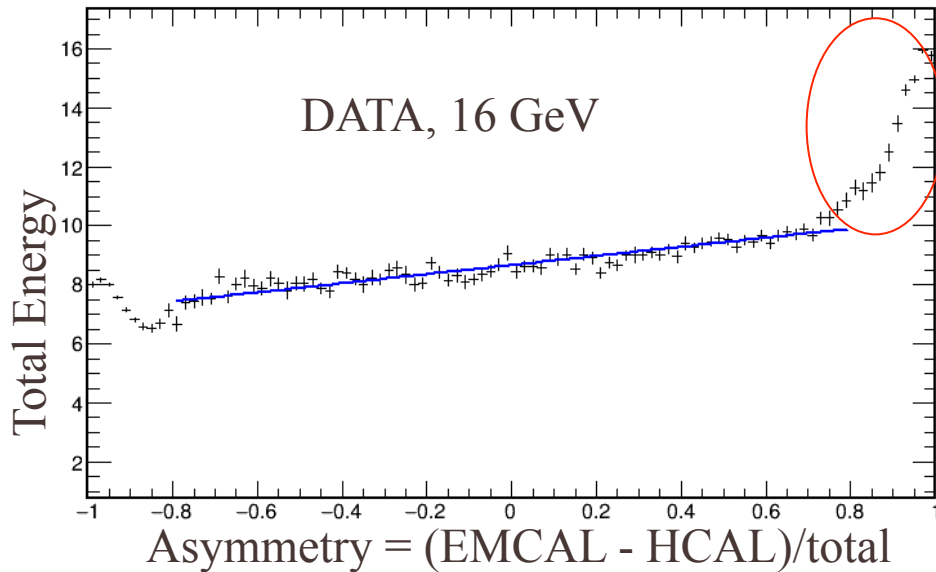
$p \sim 0.57$ averaged over all energies [8-28 GeV]

After calibration alignment



Full hadron calibration with EMCAL

Balancing EMCAL



Electrons with no Cherenkov

Expected:

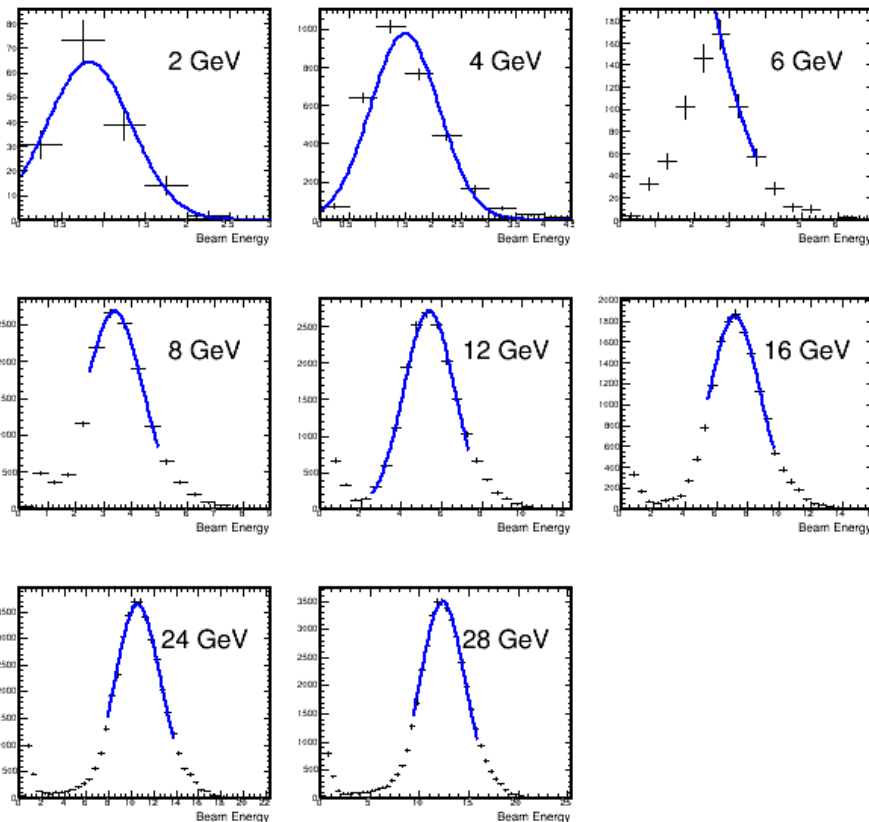
EMCAL was calibrated for electrons.
HCAL was calibrated hadrons.

EMCAL's hadron response will be
lower due to e/h response.

HCAL: Tower-to-tower calibration is
from cosmic MIP events.

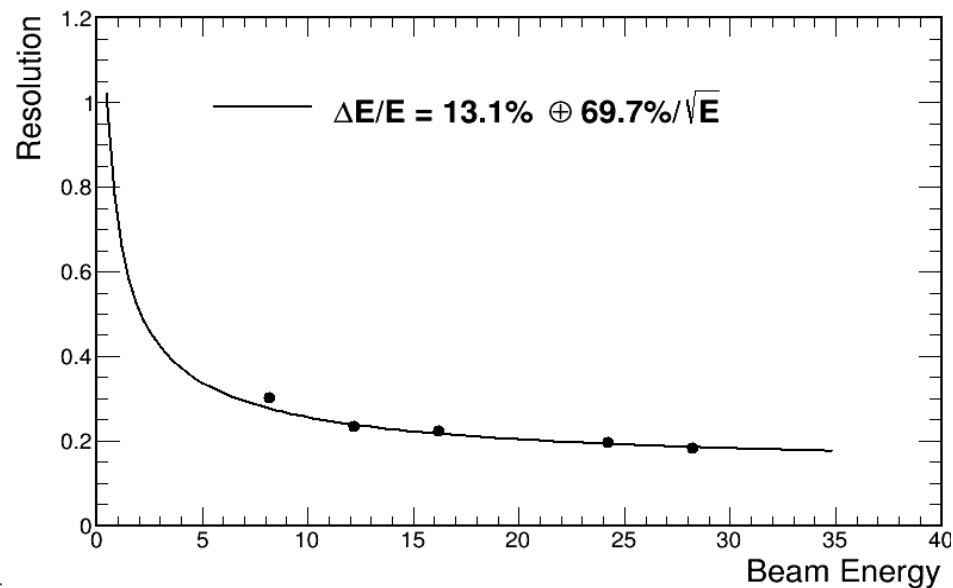
EMCAL: Tower-to-tower calibration
is from 120 GeV MIP events.

EMCAL + INNER + OUTER



EMCAL asymmetry < 0.8 to remove the electrons.

- ❖ EMCAL weight ~ 0.7 between energy 8 – 28 GeV.
- ❖ Didn't observe much energy dependence.
- ❖ This is due to “h/e”, since EMCAL was calibrated for electrons.

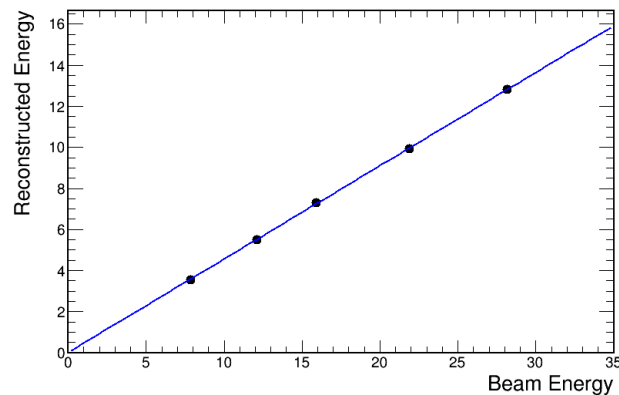
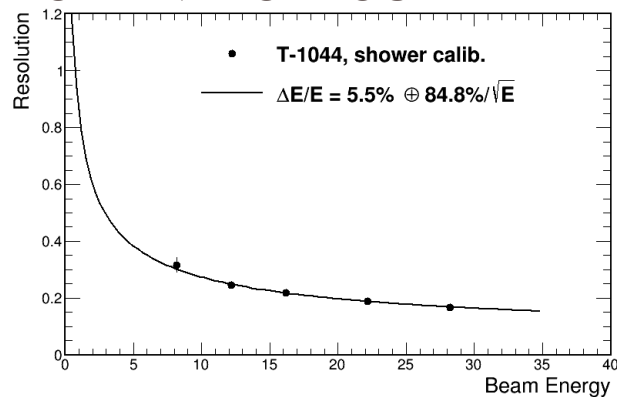


Summary

- ❖ HCAL resolution doesn't depend much on hodoscope cuts.
- ❖ Three categories of showers fully calibrated
 - All provide $<100/\sqrt{E}$ hadron resolution
- ❖ To-do: Fix the overall energy scale.
 - Move the mean of reconstructed energy to true energy.
- ❖ Almost ready for publication.

Tilt – minus 5

HCALIN+HCALOUT



EMCAL+HCALIN+HCALOUT

